

# Memorandum

August 7, 2017

To: Sean Sheldrake, U.S. Environmental Protection Agency, Region 10  
From: Ryan Barth, Anchor QEA, LLC  
cc: Bob Wyatt, NW Natural  
Patty Dost, Pearl Legal Group  
Dana Bayuk, Oregon Department of Environmental Quality  
Myron Burr, Siltronic Corporation  
Michael Murray, Maul Foster & Alongi  
Carl Stivers, Ben Hung, and John Verduin, Anchor QEA, LLC

**Re: NW Natural Proposed Summer 2017 Initial Pre-Remedial Design Data Gaps Field Sampling – Gasco Sediments Site**

As discussed with the U.S. Environmental Protection Agency (EPA) during a meeting on August 3, 2017, NW Natural requests approval from the EPA to perform an initial round of pre-design data collection at the Gasco Sediments Site in late August and early September 2017. NW Natural proposes that this initial data collection event occur during this timeframe to take advantage of annual low river water surface water elevations and to help inform the more comprehensive data gaps sampling event that will be proposed in the *Draft Pre-Remedial Design Data Gaps Work Plan and Sampling and Analysis Plan* we expect to submit to EPA in late 2017 or early 2018, in accordance with the EPA-approved Gasco Sediments Site revised Schedule of Project Deliverables (Anchor QEA 2017). NW Natural understands that the more comprehensive data gaps sampling event will include additional sampling locations and media to support a broader set of data objectives. This initial data collection event is not intended to modify the process for determination of data objectives and uses described in NW Natural's *Pre-Remedial Basis of Design Technical Evaluations Work Plan* (Work Plan; Anchor QEA 2017).

This initial data collection event will include the deployment of seepage meters to collect empirical data for offshore groundwater seepage at the Site in accordance with EPA's request in its letter dated April 4, 2017 (EPA 2017), and the data gaps sampling proposed in the Work Plan. Groundwater seepage data collection is ideal during the late summer and early fall (i.e., August through October) because the low river surface water elevations relative to high upland groundwater elevations result in the highest potential groundwater seepage fluxes. Empirical measurements of groundwater seepage were previously conducted at the Site by both the Lower Willamette Group (LWG) in August 2005 (Integral 2005) and by NW Natural in October 2007 (Anchor Environmental 2007). However, these collection efforts occurred prior to operation of the hydraulic control and containment (HC&C) system installed as part of the upland source controls for the Gasco property. During this proposed

event, NW Natural will measure groundwater seepage during similar low river surface water elevations and while the HC&C system is operating at full scale.

In addition to seepage meter deployment, NW Natural proposes to collect transition zone water (TZW; porewater), near-bottom surface water, and surface sediment samples co-located with the seepage meters to further inform the more comprehensive data gaps sampling plan that will be proposed in the *Draft Pre-Remedial Design Data Gaps Work Plan and Sampling and Analysis Plan* and support forthcoming remedial design evaluations presented in the Work Plan. The proposed sampling methodologies for each of these media will be consistent with the methodologies previously executed at the Site pursuant to EPA-approved quality assurance project plans (QAPPs) and field sampling plans (FSPs).

The remainder of this memorandum summarizes the scope of work for all proposed sampling activities and provides references to the previously EPA-approved QAPPs and FSPs.

## **Offshore Groundwater Seepage Meters**

NW Natural proposes to deploy the identical type of seepage meter used by the LWG and NW Natural during the 2005 and 2007 groundwater seepage investigations, respectively, to obtain empirical data on zones of groundwater discharge and recharge at the Site. A detailed description of these meters and the type of data that will be obtained is provided in the *Portland Harbor RI/FS Round 2 Groundwater Pathway Assessment Sampling and Analysis Plan – Attachment 1 Field Sampling Plan Groundwater Plume Discharge Mapping* (Integral 2005). In summary, the meters are ultrasonic seepage meters available through Coastal Monitoring Associates (CMA) located in San Diego, California. Ultrasonic seepage meters are capable of time-series flow rate measurement, which captures both positive and negative seepage at the surface water-sediment interface. Conductivity, temperature, and pressure measurements may also be recorded from sensors mounted on the meter to support the seepage flux evaluations.

NW Natural proposes the deployment of six seepage meters in the offshore area of the Site that will be submerged during predicted summer river surface elevations. The target locations are shown in Figure 1, and the coordinates are listed in Table 1. The locations were determined based on the total number of available seepage meters (six) from CMA, co-location with four offshore locations previously sampled by LWG and NW Natural, areas that showed a large range of positive/negative fluxes prior to installation of the HC&C system, and spatial coverage of the offshore area of the Site that includes both capping and dredging remedial technologies identified in the Record of Decision. The seepage meters need to be deployed in at least 5 feet of river water to remain submerged during deployment, so each of the target locations are limited to the offshore portion of the Site, as shown in Figure 1. Groundwater seepage data from additional locations in the nearshore area of the Site should also be collected during the winter months with higher river surface elevations.

Deployment of seepage meters at additional nearshore locations throughout the Site will be proposed in the more comprehensive *Pre-Remedial Design Data Gaps Work Plan and Sampling and Analysis Plan* for consideration by EPA.

CMA is available to deploy the seepage meters in late August and early September 2017. All meters will be deployed by a certified dive team under an EPA-approved diver Health and Safety Plan. EPA has previously reviewed and approved CMA diver Health and Safety Plans developed for work performed at the Site for both the LWG and NW Natural. NW Natural proposes deployment of each seepage meter for a period of 2 to 3 days (the maximum battery duration for the meters), consistent with past Site deployments, to update groundwater seepage variations over multiple tidal cycles. The proposed seepage meter discharge flow measurement, decontamination, and field documentation procedures will be performed consistent with the *Portland Harbor RI/FS Round 2 Groundwater Pathway Assessment Sampling and Analysis Plan – Attachment 1 Field Sampling Plan Groundwater Plume Discharge Mapping* (Integral 2005).

## **TZW and Near-Bottom Surface Water**

NW Natural proposes to collect TZW and near-bottom surface water co-located with the six proposed seepage meters. The LWG and NW Natural have previously collected TZW samples at the Site using a variety of sampling equipment, including piezometers, “Trident” probes, and Geoprobe water samplers. Trident probes were developed by CMA, who will perform the seepage meter deployment, and were successfully used to collect TZW samples by the LWG in 2005. Therefore, NW Natural proposes to use Trident probes for this proposed sampling event.

The proposed Trident probe sampling will be conducted in accordance with the sampling, decontamination, quality control (QC), sample handling, and field documentation procedures detailed in the *Portland Harbor RI/FS Round 2 Groundwater Pathway Assessment Sampling and Analysis Plan – Attachment 1 Field Sampling Plan Groundwater Plume Discharge Mapping* (Integral 2005). In summary, the Trident probe is a simple, direct-push system equipped with temperature, conductivity, and water sampling probes. The Trident Probe will be deployed by a diver. The sampling port will be inserted 30 cm below the mudline, consistent with previous TZW sampling events at the Site. TZW will be extracted from the Trident probe using a low-flow peristaltic pump. The probe and sampling tube will be purged of approximately three volumes before samples are collected. During purging and sampling, the TZW will be simultaneously monitored for temperature and conductivity to determine if river water is infiltrating the sediment and diluting the TZW.

Unfiltered (total) samples of the constituents listed in Table 2 will first be collected. If sufficient sample volume is available, samples will also be collected for filtered (dissolved) phase analyses. If sufficient volume is available, filtering will be performed in the analytical laboratory as soon as possible upon receipt using either centrifugation and/or a 0.5-micron glass fiber filter. Volatile

organic compounds (VOCs) will not be filtered; only total VOCs will be analyzed. Observations of turbidity or suspended sediments in the TZW samples will be recorded in the field notes, and if sufficient sample volume remains after all total and dissolved species have been collected, total suspended solids (TSS) will also be analyzed from an unfiltered sample. The guidelines for sample handling and storage are provided in Table 3.

Co-located near-bottom surface water samples will be collected approximately 1 foot above the riverbed concurrently with the TZW samples. An additional pumping tube will be attached to the Trident probe, and its intake will be positioned 1 foot above the seal plate of the Trident probe assembly. Similar to the TZW samples, the near-bottom surface water will also be collected using a low-flow peristaltic pump. The sampling tube will be purged of approximately three volumes before samples are collected. Unfiltered (total) samples of the constituents listed in Table 2 will be collected. No filtered (dissolved) samples will be collected except for dissolved organic carbon. The filtering will be performed in the analytical laboratory as soon as possible upon receipt using either centrifugation and/or a 0.5-micron glass fiber filter.

## **Surface Sediment**

In addition to the co-located TZW and near-bottom surface water samples, NW Natural proposes to collect a single surface sediment sample co-located with each of the six proposed seepage meters. NW Natural most recently collected surface sediment samples using a van Veen sampling device in 2010, as outlined in the EPA-approved *Final Project Area Identification Report and Data Gaps QAPP* (Project AIR; Anchor QEA 2010). In summary, the van Veen grab sampler will be lowered to the mudline, the cable will be drawn taut to collect the sample, and the sampler will be retrieved aboard the vessel and evaluated for acceptance using the acceptability criteria. Immediately following opening of the grab, a representative sample to be analyzed for VOCs will be collected from the upper 1 foot of sediment using a clean, stainless-steel spoon and placed into a laboratory-provided sample container. The sample will then be photographed and logged, and any present debris will be removed. The upper 1 foot of sediment from inside the van Veen grab sampler, without touching the sidewalls, using a decontaminated stainless-steel trowel or equivalent will be collected, placed into a single decontaminated stainless-steel bowl, and completely homogenized. The laboratory-provided sample containers will be filled with the homogenized sediment.

Sediment collection, sample processing, sample handling, field quality assurance (QA)/QC sampling, field documentation, decontamination, and investigation derived waste procedures are described in detail in the Project AIR, and the proposed surface sediment sampling will be performed consistent with the procedures. The surface sediment samples will be analyzed for the specific analytes, methods, reporting limits, and detection limits in Table 4 to support sediment remedial design consistent with the Record of Decision requirements. In addition, a few additional analyses will be performed to assist with polycyclic aromatic hydrocarbon (PAH) source identification. The additional

PAH data will be submitted to EPA concurrent with the data used for remedial design purposes. Table 5 presents the guidelines for sample handling and storage for collected sediment.

## **Data Quality Objectives and QA/QC Sampling**

The primary data quality objective for this initial round of data collection is to ensure that the data collected are of known and acceptable quality. The quality of the laboratory data is assessed by precision, accuracy, representativeness, comparability, and completeness (also known as the "PARCC" parameters). Definitions of these parameters and the applicable QC procedures are included in the Project AIR (Anchor QEA 2010). To expedite EPA's review of this proposal, reproduced herein are the applicable quantitative goals for these data quality parameters in Table 6 for TZW and near-bottom surface water and in Table 7 for surface sediment. Field and laboratory QA/QC procedures are also detailed in the Project AIR. Copies of the Laboratory QC Sample Analysis Frequency and Field QC Samples Acceptance Criteria for all proposed sampling media are presented in Tables 8 and 9, respectively.

## **References**

- Anchor Environmental (Anchor Environmental, L.L.C.), 2007. Letter to: Dana Bayuk, Oregon Department of Environmental Quality. Regarding: Proposed Groundwater Seepage Meter Deployment Scope of Work – Gasco Site. August 22, 2007.
- Anchor QEA (Anchor QEA, LLC), 2010. *Final Project Area Identification Report and Data Gaps QAPP*. Prepared for the U.S. Environmental Protection Agency. Prepared on behalf of NW Natural. July 2010.
- Anchor QEA, 2017. *Pre-Remedial Basis of Design Technical Evaluations Work Plan*. Prepared for the U.S. Environmental Protection Agency. Prepared on behalf of NW Natural. July 2017.
- EPA (U.S. Environmental Protection Agency), 2017. Letter to: Bob Wyatt, NW Natural, and Myron Burr, Siltronic Corporation. Regarding: Gasco Groundwater Modelling Report, NW Natural Site. April 4, 2017.
- Integral (Integral Consulting, Inc.), 2005. *Portland Harbor RI/FS Round 2 Groundwater Pathway Assessment Sampling and Analysis Plan – Attachment 1: Field Sampling Plan Groundwater Plume Discharge Mapping*. Prepared for the Lower Willamette Group. July 1, 2005.

## Tables

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**Table 1****Proposed Co-Located Seepage Meter, Porewater, Near-Bottom Surface Water, and Surface Sediment Sampling Locations**

<b>Station ID</b>	<b>Latitude (NAD83)</b>	<b>Longitude (NAD83)</b>
GRD-01	45.58108110	-122.7604816
GRD-02	45.58000756	-122.7582451
GRD-03	45.57967074	-122.7569223
GRD-04	45.57942072	-122.7560316
GRD-05	45.57908557	-122.7552007
GRD-06	45.57821239	-122.7530541

Note:

NAD83: North American Datum of 1983

**Table 2****Analytes, Analysis Methods, and Targeted Reporting Limits – TZW and Near-Bottom Surface Water**

Parameter	Recommended Analytical Method	Units	MDL	Reporting Limit	Fraction	
					Total	Dissolved <sup>1</sup>
Conventionals						
Total suspended solids	SM 2540 D	mg/L	5	5	X	
Total organic carbon	SM 5310 B	mg/L	1	1	X	
Dissolved organic carbon	SM 5310 B	mg/L	1	1		X
Polycyclic Aromatic Hydrocarbons						
Acenaphthene	USEPA 8270D-SIM	µg/L	0.02	0.04	X	X
Acenaphthylene	USEPA 8270D-SIM	µg/L	0.02	0.04	X	X
Anthracene	USEPA 8270D-SIM	µg/L	0.02	0.04	X	X
Benzo(a)anthracene	USEPA 8270D-SIM	µg/L	0.02	0.04	X	X
Benzo(a)pyrene	USEPA 8270D-SIM	µg/L	0.02	0.04	X	X
Benzo(b)fluoranthenes	USEPA 8270D-SIM	µg/L	0.02	0.04	X	X
Benzo(g,h,i)perylene	USEPA 8270D-SIM	µg/L	0.02	0.04	X	X
Benzo(k)fluoranthenes	USEPA 8270D-SIM	µg/L	0.02	0.04	X	X
Chrysene	USEPA 8270D-SIM	µg/L	0.02	0.04	X	X
Dibenz(a,h)anthracene	USEPA 8270D-SIM	µg/L	0.02	0.04	X	X
Fluoranthene	USEPA 8270D-SIM	µg/L	0.02	0.04	X	X
Fluorene	USEPA 8270D-SIM	µg/L	0.02	0.04	X	X
Indeno(1,2,3-cd)pyrene	USEPA 8270D-SIM	µg/L	0.02	0.04	X	X
Naphthalene	USEPA 8270D-SIM	µg/L	0.04	0.08	X	X
Perylene	USEPA 8270D-SIM	µg/L	0.04	0.08	X	X
Phenanthrene	USEPA 8270D-SIM	µg/L	0.02	0.04	X	X
Pyrene	USEPA 8270D-SIM	µg/L	0.02	0.04	X	X
Volatile Organic Compounds <sup>2</sup>						
Benzene	USEPA 8260C	µg/L	0.125	0.25	X	
Ethylbenzene	USEPA 8260C	µg/L	0.25	0.5	X	
Toluene	USEPA 8260C	µg/L	0.5	1	X	
m,p-Xylene	USEPA 8260C	µg/L	0.5	1	X	
o-Xylene	USEPA 8260C	µg/L	0.25	0.5	X	

**Table 2****Analytes, Analysis Methods, and Targeted Reporting Limits – TZW and Near-Bottom Surface Water**

Parameter	Recommended Analytical Method	Units	MDL	Reporting Limit	Fraction	
					Total	Dissolved <sup>1</sup>
Trichloroethene (TCE)	USEPA 8260C	µg/L	0.25	0.5	X	
cis-1,2-Dichloroethene (cis-DCE)	USEPA 8260C	µg/L	0.25	0.5	X	
trans-1,2-Dichloroethene (trans-DCE)	USEPA 8260C	µg/L	0.25	0.5	X	
1,1-Dichloroethene (1,1-DCE)	USEPA 8260C	µg/L	0.25	0.5	X	
Vinyl chloride	USEPA 8260C	µg/L	0.25	0.5	X	

## Notes:

1. Dissolved organic carbon is the only dissolved parameter that will be collected for near-bottom surface water samples. All dissolved samples will be processed as soon as possible upon receipt at the laboratory using either centrifugation and/or a 0.5-micron glass fiber filter.

2. Only the total fraction for volatile organics will be calculated due to loss of volatiles during filtration.

µg/L: micrograms per liter

MDL: method detection limit

TZW: transition zone water

**Table 3**  
**Guidelines for Sample Handling and Storage – TZW and Near-Bottom Surface Water**

Parameter	Sample Size	Container Size and Type	Holding Time	Sample Preservation Technique
Total suspended solids	1 L	1-L HDPE	7 days	Cool 4 °C
Total organic carbon	50 mL	250-mL HDPE	28 days	H2SO4 to pH<2, cool 4 °C
Dissolved organic carbon	50 mL	250-mL HDPE	28 days	Filter, H2SO4 to pH<2, cool 4 °C
PAHs	100 mL	120-mL amber glass	7 days to extraction, 40 days to analysis	Cool 4 °C
VOCs	5 mL	40-mL VOA vial with PTFE-lined septum caps (3x)	14 days	Zero head space/Cool 4 °C/ HCL to pH<2

Notes:

H2SO4: sulfuric acid

HCL: hydrochloride

HDPE: high-density polyethylene

L: liter

mL: milliliter

PAH: polycyclic aromatic hydrocarbon

PCB: polychlorinated biphenyl

PTFE: polytetrafluoroethylene (Teflon)

TZW: transition zone water

VOA: volatile organic analysis

VOC: volatile organic compound

**Table 4****Analytes, Analysis Methods, and Targeted Reporting Limits – Surface Sediments**

Parameter	Recommended Analytical Method	Units	MDL	Reporting Limit <sup>1</sup>
<b>Conventional/Physical Parameters</b>				
Total solids	USEPA 160.3	% wet weight	NA	0.1
Total organic carbon	USEPA 9060	%	0.02	0.01
Grain size (with hydrometer)	ASTMD422	% retained	NA	0.1
<b>Polycyclic Aromatic Hydrocarbons</b>				
Acenaphthene	USEPA 8270C-SIM	µg/kg	0.667	1.67
Acenaphthylene	USEPA 8270C-SIM	µg/kg	0.667	1.67
Anthracene	USEPA 8270C-SIM	µg/kg	0.667	1.67
Benzo(a)anthracene	USEPA 8270C-SIM	µg/kg	0.667	1.67
Benzo(a)pyrene	USEPA 8270C-SIM	µg/kg	0.667	1.67
Benzo(b)fluoranthene	USEPA 8270C-SIM	µg/kg	0.667	1.67
Benzo(g,h,i)perylene	USEPA 8270C-SIM	µg/kg	0.667	1.67
Benzo(k)fluoranthene	USEPA 8270C-SIM	µg/kg	0.667	1.67
Chrysene	USEPA 8270C-SIM	µg/kg	0.667	1.67
Dibenz(a,h)anthracene	USEPA 8270C-SIM	µg/kg	0.667	1.67
Fluoranthene	USEPA 8270C-SIM	µg/kg	0.667	1.67
Fluorene	USEPA 8270C-SIM	µg/kg	0.667	1.67
Indeno(1,2,3-cd)pyrene	USEPA 8270C-SIM	µg/kg	0.667	1.67
Naphthalene	USEPA 8270C-SIM	µg/kg	0.667	1.67
Perylene	USEPA 8270C-SIM	µg/kg	0.667	1.67
Phenanthrene	USEPA 8270C-SIM	µg/kg	0.667	1.67
Pyrene	USEPA 8270C-SIM	µg/kg	0.667	1.67
<b>Volatile Organic Compounds</b>				
Benzene	USEPA 8260C	µg/kg	6.25	12.5
Ethylbenzene	USEPA 8260C	µg/kg	12.5	25
Toluene	USEPA 8260C	µg/kg	12.5	25
m,p-Xylene	USEPA 8260C	µg/kg	25	50
o-Xylene	USEPA 8260C	µg/kg	12.5	25
Trichloroethene (TCE)	USEPA 8260C	µg/kg	12.5	25
cis-1,2-Dichloroethene (cis-DCE)	USEPA 8260C	µg/kg	12.5	25
trans-1,2-Dichloroethene (trans-DCE)	USEPA 8260C	µg/kg	12.5	25
1,1-Dichloroethene (1,1-DCE)	USEPA 8260C	µg/kg	12.5	25
Vinyl chloride	USEPA 8260C	µg/kg	12.5	25
<b>Pesticides</b>				
2,4-DDD	USEPA 8081B	µg/kg	0.5	1
2,4-DDE	USEPA 8081B	µg/kg	0.5	1
2,4-DDT	USEPA 8081B	µg/kg	0.5	1
4,4-DDD	USEPA 8081B	µg/kg	0.5	1

**Table 4****Analytes, Analysis Methods, and Targeted Reporting Limits – Surface Sediments**

Parameter	Recommended Analytical Method	Units	MDL	Reporting Limit <sup>1</sup>
4,4-DDE	USEPA 8081B	µg/kg	0.5	1
4,4-DDT	USEPA 8081B	µg/kg	0.5	1
<b>Dioxin/Furans</b>				
2,3,7,8-TCDF	USEPA 8290	pg/g	0.109	0.5
2,3,7,8-TCDD	USEPA 8290	pg/g	0.126	0.5
1,2,3,7,8-PeCDF	USEPA 8290	pg/g	0.301	2.5
2,3,4,7,8-PeCDF	USEPA 8290	pg/g	0.288	2.5
1,2,3,7,8-PeCDD	USEPA 8290	pg/g	0.285	2.5
1,2,3,4,7,8-HxCDF	USEPA 8290	pg/g	0.37	2.5
1,2,3,6,7,8-HxCDF	USEPA 8290	pg/g	0.392	2.5
2,3,4,6,7,8-HxCDF	USEPA 8290	pg/g	0.38	2.5
1,2,3,7,8,9-HxCDF	USEPA 8290	pg/g	0.47	2.5
1,2,3,4,7,8-HxCDD	USEPA 8290	pg/g	0.252	2.5
1,2,3,6,7,8-HxCDD	USEPA 8290	pg/g	0.364	2.5
1,2,3,7,8,9-HxCDD	USEPA 8290	pg/g	0.237	2.5
1,2,3,4,6,7,8-HpCDF	USEPA 8290	pg/g	0.392	2.5
1,2,3,4,7,8,9-HpCDF	USEPA 8290	pg/g	0.38	2.5
1,2,3,4,6,7,8-HpCDD	USEPA 8290	pg/g	0.288	2.5
OCDF	USEPA 8290	pg/g	0.868	5
OCDD	USEPA 8290	pg/g	0.646	5
<b>PCB Congeners</b>				
1 – 209	USEPA 1668A	pg/g	0.052 – 9.08	10 – 20

## Notes:

1. Reporting limits may vary due to moisture content of sample.

µg/kg: micrograms per kilogram

MDL: method detection limit

NA: not applicable

PAH: polycyclic aromatic hydrocarbon

PCB: polychlorinated biphenyl

pg/g: picograms per gram

TPH: total petroleum hydrocarbon

**Table 5**  
**Guidelines for Sample Handling and Storage – Surface Sediments**

Parameter	Sample Size	Container Size and Type <sup>1</sup>	Holding Time	Sample Preservation Technique
Total solids	50 g	16-oz glass	None	Ambient temperature
Total organic carbon	50 g	From TS container	28 days	Cool/4 °C
			6 months	Freeze -18 °C
Grain size	300 g	16-oz HDPE	No hold time	Ambient temperature
VOCs	5 g	40-mL VOA vial with PTFE-lined septum caps (3x)	14 days	Cool/4 °C/MeOH
Pesticides	150 g	16-oz glass	14 days until extraction	Cool/4 °C
			1 year until extraction	Freeze -18 °C
			40 days after extraction	Cool/4 °C
PAHs	150 g	8-oz glass	14 days until extraction	Cool/<6 °C
			1 year until extraction	Freeze/-18 °C
			40 days after extraction	Cool/<6 °C
PCB congeners	50 g	8-oz amber glass	None	Cool/4 °C
Dioxin/Furans	50 g	From PCB congener jar	None	Cool/4 °C

Notes:

1. Container size, type, and sample size required may change based on laboratory guidance.

g: gram

HDPE: high-density polyethylene

MeOH: methanol

oz: ounce

PAH: polycyclic aromatic hydrocarbon

PCB: polychlorinated biphenyl

PTFE: polytetrafluoroethylene (Teflon)

TS: total solids

VOA: volatile organic analysis

VOC: volatile organic compound

**Table 6****Data Quality Objectives for TZW and Near-Bottom Surface Water**

Parameter	Precision (Duplicate RPD)	Accuracy (Spike Recoveries)	Completeness
Total suspended solids	+/- 20% RPD	80-120% R	95%
Total organic carbon	+/- 20% RPD	80-120% R	95%
Dissolved organic carbon	+/- 20% RPD	80-120% R	95%
Polycyclic aromatic hydrocarbons	+/- 30% RPD	50-150% R	95%
Volatile organic compounds	+/- 30% RPD	50-150% R	95%

Notes:

R: recovery

RPD: relative percent difference

TZW: transition zone water

**Table 7**  
**Data Quality Objectives for Surface Sediments**

Parameter	Precision (Duplicate RPD)	Accuracy (Spike Recoveries)	Completeness
Total solids	+/- 20% RPD	NA	95%
Total organic carbon	+/- 20% RPD	80-120% R	95%
Grain size	+/- 20% RPD	NA	95%
Polycyclic aromatic hydrocarbons	+/- 35% RPD	50-150% R	95%
Volatile organic compounds	+/- 35% RPD	50-150% R	95%
Pesticides	+/- 35% RPD	50-150% R	95%
Dioxin/Furans	+/- 35% RPD	50-150% R	95%
PCB congeners	+/- 35% RPD	50-150% R	95%

Notes:

NA: not applicable

PCB: polychlorinated biphenyl

R: recovery

RPD: relative percent difference

**Table 8**  
**Laboratory Quality Control Sample Analysis Frequency**

Analysis Type	Initial Calibration	Ongoing Calibration	LCS/SRM <sup>2</sup>	Replicates	Matrix Spikes	Matrix Spike Duplicates	Method Blanks	Surrogate Spikes
Total solids	Each batch	NA	NA	1 per 20 samples	NA	NA	NA	NA
Total organic carbon	Daily or each batch	1 per 10 samples	1 per 20 samples	1 per 20 samples	1 per 20 samples	NA	1 per 20 samples	NA
Dissolved organic carbon	Daily or each batch	1 per 10 samples	1 per 20 samples	1 per 20 samples	1 per 20 samples	NA	1 per 20 samples	NA
Grain size	Each batch	NA	NA	1 per 20 samples	NA	NA	NA	NA
Polycyclic aromatic hydrocarbons	As needed <sup>1</sup>	Every 12 hours	1 per 20 samples	NA <sup>3</sup>	1 per 20 samples	1 per 20 samples	1 per 20 samples	Every sample
Volatile organic compounds	As needed <sup>1</sup>	Every 12 hours	1 per 20 samples	NA <sup>3</sup>	1 per 20 samples	1 per 20 samples	1 per 20 samples	Every sample
Pesticides	As needed <sup>1</sup>	Every 12 hours	1 per 20 samples	NA <sup>3</sup>	1 per 20 samples	1 per 20 samples	1 per 20 samples	Every sample
Dioxin/Furans and PCB congeners	As needed <sup>1</sup>	Every 12 hours	1 per 20 samples	1 per 20 samples	NA <sup>4</sup>	NA <sup>4</sup>	1 per 20 samples	Every sample

Notes:

1. Initial calibrations are considered valid until the ongoing continuing calibration no longer meets method specifications. At that point, a new initial calibration is performed.

2. When a standard reference material is available it may be used in lieu of an LCS.

3. A matrix spike/matrix spike duplicate (MS/MSD) may be analyzed in lieu of a sample replicate.

4. Isotope dilution is required by the method.

LCS: laboratory control sample

NA: not applicable

PCB: polychlorinated biphenyl

SRM: standard reference material

**Table 9**  
**Field Quality Control Samples Acceptance Criteria**

Field Quality Control Sample	Frequency of Analysis	Acceptance Criteria
Rinsate Wipe/Blank	1 per sampling equipment per sampling event	Non-detect; less than 5 times sample concentration; or sample result is non-detect
Filter/Rinsate Blank	1 per sampling equipment per sampling event	Non-detect; less than 5 times sample concentration; or sample result is non-detect
Trip Blank	Each cooler with VOC samples	Non-detect; less than 5 times sample concentration; or sample result is non-detect
Field Duplicate	1 per 20 samples	± 50% RPD

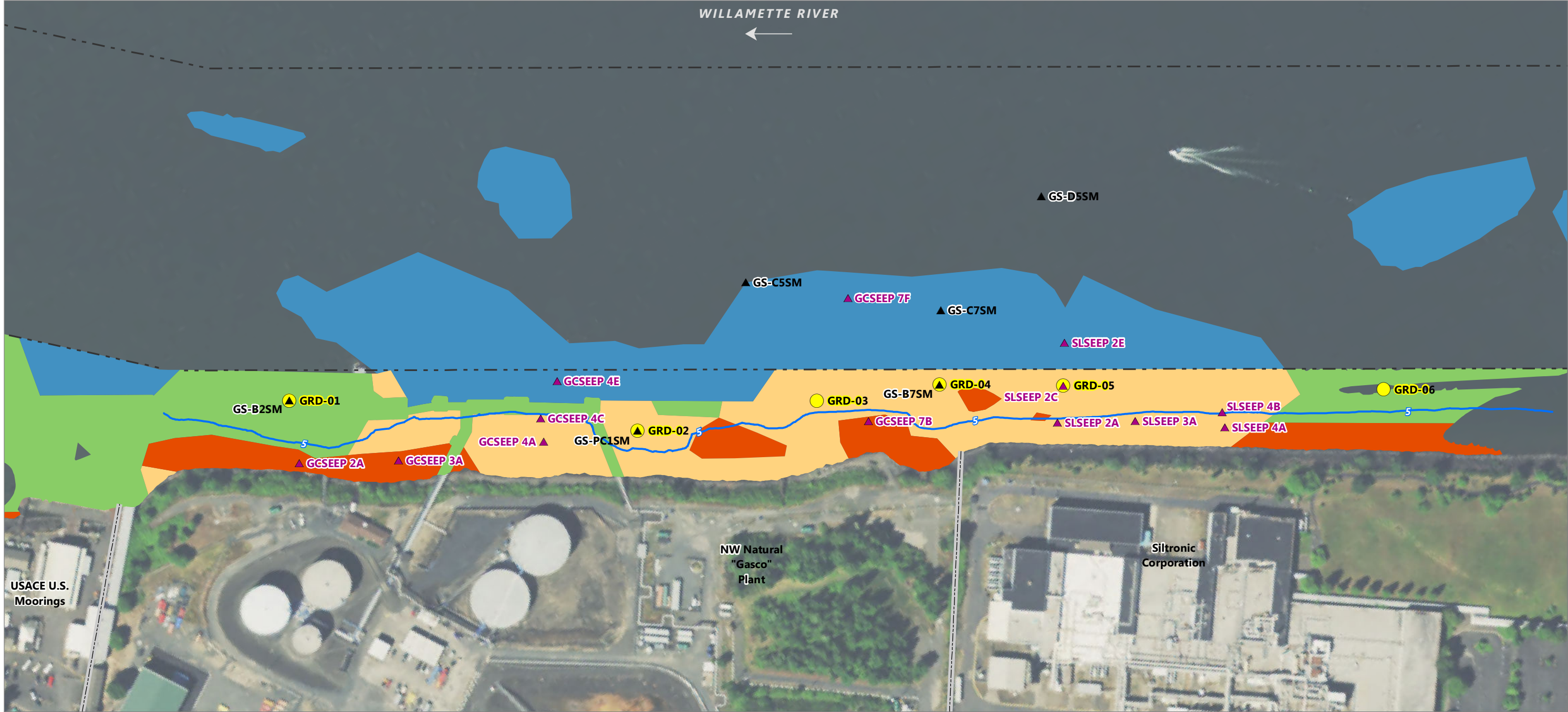
Notes:

RPD: relative percent difference

VOC: volatile organic compound

Figure

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**LEGEND:**

- Navigation Channel
- Property Line
- ROD Technology Assignment**
- Cap
- Dredge
- Dredge in Nav-FMD
- Dredge with Cap
- Proposed Co-located Groundwater Seepage Meter, Porewater, Near-bottom Surface Water, and Surface Sediment Sampling Location
- NW Natural Gasco Offshore Seepage Meter (2007)
- LWG Offshore Seepage Meter (2005)
- Average 5-foot Water Depth (July-October)

**NOTE(S):**

- Arrow indicates direction of flow of river.
- Horizontal datum is NAD83 HARN Oregon State Plane North, Intl. Feet.
- Vertical datum is City of Portland, feet.
- Aerial imagery from 2014 NAIP.

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**Figure 1**  
**Proposed Co-Located Groundwater Seepage Meter, Porewater, Near-Bottom Surface Water, and Surface Sediment Sampling Locations**  
Summer 2017 Pre-Design Data Gaps Sampling Proposal  
Gasco Sediments Cleanup Action